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Proceedings
of the

20th Nitrogen WORKSHOP

"Coupling C - N - P - S cycles"

June 25-27, 2018

Rennes, France
Couvent des Jacobins
Conference Centre

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LIVING COVER COMPETITION IN BANANA PLANTATION AND NITROGEN MANAGEMENT AFTER A LEGUME COVER CROP ROTATION

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INTRODUCTION

Intercropping banana with a mown spontaneous cover or sown cover crop represents an alternative to herbicide use for the control of weeds. Intercropping a living cover induces nitrogen competition for the banana during the first crop cycle, then for following cycles the lower growth of the cover and the cycling of nutrient induced negligible competition effects (Achard, 2016). In that case, maintaining crop productivity for the first cycle supposed to compensate the additional nitrogen demand of the living cover by increasing N fertilization. An adaptation of N fertilization program to banana plantation with living covers without increasing N leaching, has been proposed through a modeling approach (Ripoche *et al*, 2012). The current question is to design herbicide free banana cropping system integrating living cover, in order to compensate the additional nitrogen demand of the living cover and ensuring a sufficient nitrogen availability to maintain banana productivity, without increasing leaching risk. The goal of this study was to evaluate, in the field, the performance of two herbicide free banana management options based on mechanical control of weeds after a previous cover crop, and determine if those options would require an increase of N fertilization and/or would increase nitrogen leaching risk.

MATERIAL AND METHODS

The study was carried out in Martinique on nitisols, with a mean annual rainfall of 2400mm. Eleven month after sowing *Stylosanthes guianensis*, the cover crop was destroyed by mowing before banana plantation. The field trial compared three management treatments through a randomized block design with three replicates. The first management treatment (MW) combined no tillage, mulched soil with cover crop residues and weed control by mowing. The second treatment (PW) combined a soil tillage with a weed control by mowing and the control treatment (CT) consist in a conventional chemical control of weeds. Banana in vitro derived plantlets were planted with a 2.65 m x 1.5 m spacing, i.e. 4m² per plant. The fertilization corresponded to common producer's practice, and was equal for all treatments: 9 g N per plant at planting and 28 g N per plant at 60 and 120 days after planting (DAP), i.e. a total amount of 110 kg $N.ha^{-1}$ during this study. For P and K, the fertilization ensured a non-limiting nutrition of the banana plants. Each experimental plot consisted of six banana plants, surrounded by a border. The weed biomass was evaluated by destructive observations on 0.25 m² area per plot, randomly localized. The weed biomass was negligible on CT. The banana growth was estimated through the pseudostem girth and the leaf emission, the biomass of banana plants was estimated by an allometric relation. The relation between %N content and the banana biomass from Thieuleux (2006) was used.

RESULTS AND DISCUSSION

Cover crop production and weed growth

At 30 days after planting (DAP), despite the mulch of *S. guianensis*, MW had significantly higher weed biomass in comparison to PW (130 g/m² vs 50 g/m²), meaning that mulching with *S. guianensis* is less efficient than soil tillage for controlling weed emergence. At 100 DAP, just before the first mowing, weed biomass remained higher on MW treatment than on PW with 0.88 and 0.44 kgDM/m² (corresponding to 18 and 9 gN/m²), respectively.

Banana growth response

Banana plants had similar growth response in CT and PW (cf. table1) until 100 DAP. However, at 160 DAP on PW, banana plants had lower growth and leaves emission. As CT and PW managements distinguished only according to their mowing management of weed, the depressive effect of MW reflected the weed competition effect. In

spite of a high growth of weeds, MW treatment showed better banana growth than PW and did not suffer from any reduction of banana growth in comparison to CT.

Table 1. Response of the banana pseudostem girth to experimental treatments

Experimental treatment	48 DAP		100 DAP		160 DAP	
	C30	FE	C30	FE	C30	FE
MW: Mulch + weed cover	11.9 A	5.5	27.0 A	15.23 A	60.9 A	26.01 A
CT: Ploughing + chemical weed control	10.8 AB	5.5	24.1 AB	14.41 AB	56.8 A	25.97 A
PW: Ploughing + weed cover	9.4 B	6.1	22.3 0 B	13.96 B	49.13 B	24.25 B

Evolution of the total nitrogen uptake by plants component and the soil mineral nitrogen content

By comparing the estimated nitrogen uptake of the weeds and of the banana plants (cf. figure 1) in control treatments (CT) with PW, we observed that the high amount of nitrogen uptake by weed cover induced a reduction of other N compartment distributed among the N banana uptake and N mineral soil content. However, on MW, instead of weak depletion of mineral N of the soil, there was an increase the global N content of the agrosystem.

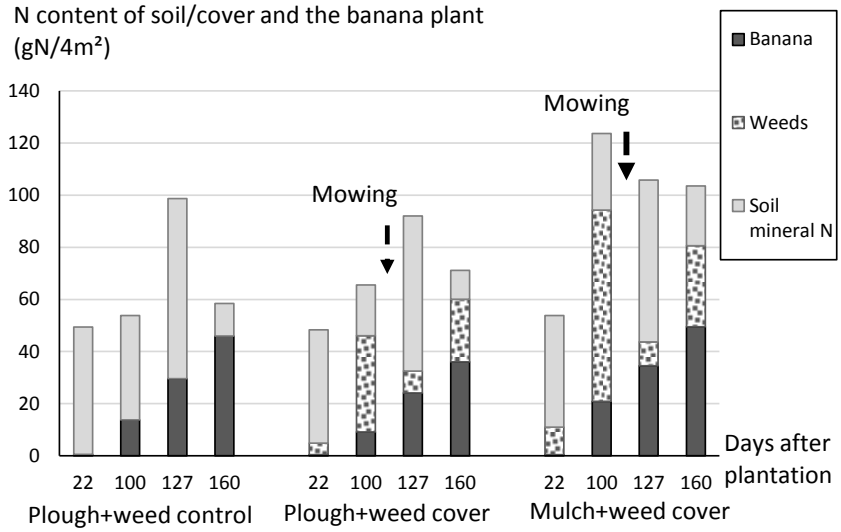

Figure 1.Dynamic of the repartition of N uptake between weeds banana crop and soil mineral nitrogen.

CONCLUSION

PW management had an impact by competing with banana growth, that needs to be compensated for by an increase of Nitrogen fertilization. As MW management has no negative impact on the banana growth this management would not require an increase of nitrogen fertilization, its higher nitrogen amount in comparison to conventional management indicated lower nitrogen leaching until this crop stage.

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